CR programming for Bucky trays with **3-field** and **5-field** chambers
Optimus and **Velara** generators

Programming film-screen data sets and their results are explained for **Optimus** first.

Optimus and the **AgenT** program provide all default value tables and the calculated tables afterwards. Such screens and the modifications can actually not be seen at **Velara** generators, but the principles and the results are identical.

The chemistry of the CR film is similar to the (wet film) screens of luminous group 6.
The values is the table determine a linear S = sensitivity value for CR systems (density for wet films) between 40...150kV..

As one can see in the following data table CR speed class 400 **(x)** has a speed of only 176 at 40kV, its highest speed is 444 at 100kV.

Name	IMAGING PLATE 400
ID No.	317
Abbreviation	B400
Colour	b
S(40)	176.00
S(50)	263.00
S(60)	350.00
S(70)	400.00
S(80)	428.00
S(90)	443.00
S(100)	444.00
S(120)	422.00
S(140)	394.00
S(150)	380.00

(x) All non-thorax screen speed classes are specified at 70kV.

To achieve a linear S-value at CR development systems a 40kV exposure requires e.g. a

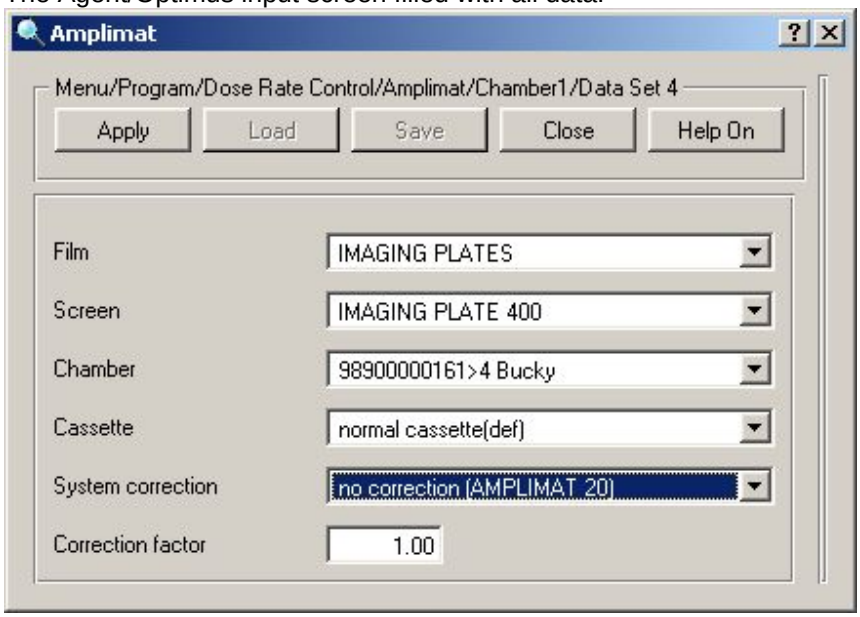
$$\frac{400}{176} = 2.3 \text{ times higher dose.}$$

Screen data are multiplied with all other items of the default programming data for the film-screen data set (see calculation table page 4).

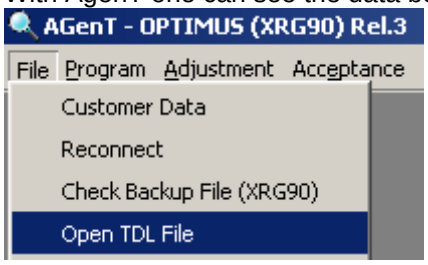
At the end of the calculation process one gets a table from 40...150kV which determines the exposure termination setpoint value for DRC = dose rate control.
This threshold value (U_off) is taken from the table according to the selected application / APR..

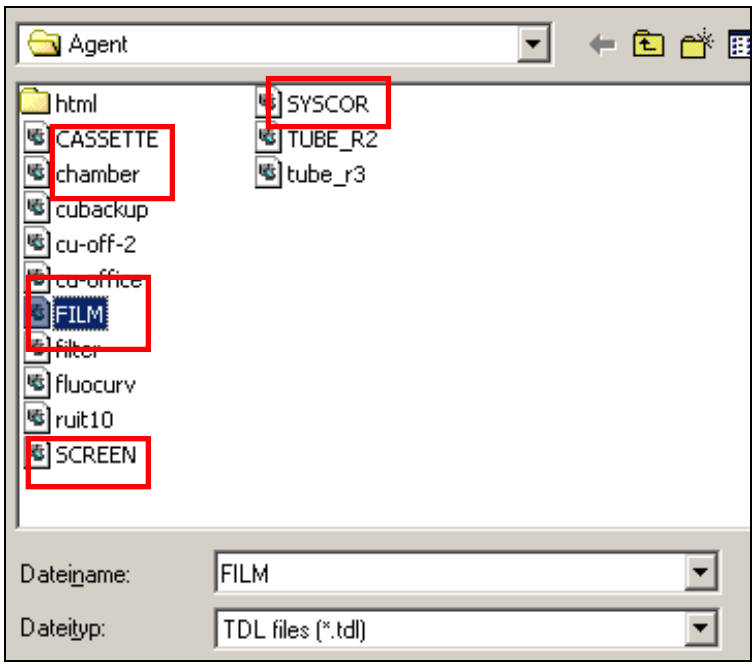
The calculation process for a 400 speed system with a 3-field Amplimat chamber 9890 000 0161>4 will be explained on the following pages. For Optimus generators the calculation is carried out on the PC, then the table is sent to the generator. The Velara process is explained on page 7.

The Agent/Optimus input screen filled with all data:



With AgenT one can see the data belonging the selected items (also possible offline):





FILM

C:/program files/Developer/Agent/FILM.TDL

Apply (F2) | Load (F3) | Save (F4) | Close | Show As Text

Name	IMAGING PLATES
ID No.	136
Abbreviation	
Factor	1.00
Colour	b
RLF t_0 [ms]	0
RLF Drel_0	1.000
RLF t_1 [ms]	10
RLF Drel_1	1.000
RLF t_2 [ms]	20
RLF Drel_2	1.000
RLF t_3 [ms]	50
RLF Drel_3	1.000
RLF t_4 [ms]	100
RLF Drel_4	1.000
RLF t_5 [ms]	200
RLF Drel_5	1.000
RLF t_6 [ms]	500
RLF Drel_6	1.000
RLF t_7 [ms]	1000
RLF Drel_7	1.000
RLF t_8 [ms]	2000
RLF Drel_8	1.000
RLF t_9 [ms]	4000
RLF Drel_9	1.000

SCREEN
see table page 1

CHAMBER

Name	98900000161>4 Bucky
ID No.	61
S all Chamber [V/æGy]	0.19
Drel(40)	0.70
Drel(50)	0.84
Drel(60)	0.93
Drel(70)	1.00
Drel(80)	1.01
Drel(90)	1.00
Drel(100)	0.99
Drel(120)	0.96
Drel(140)	0.93
Drel(150)	0.89
t-Char. ID	0

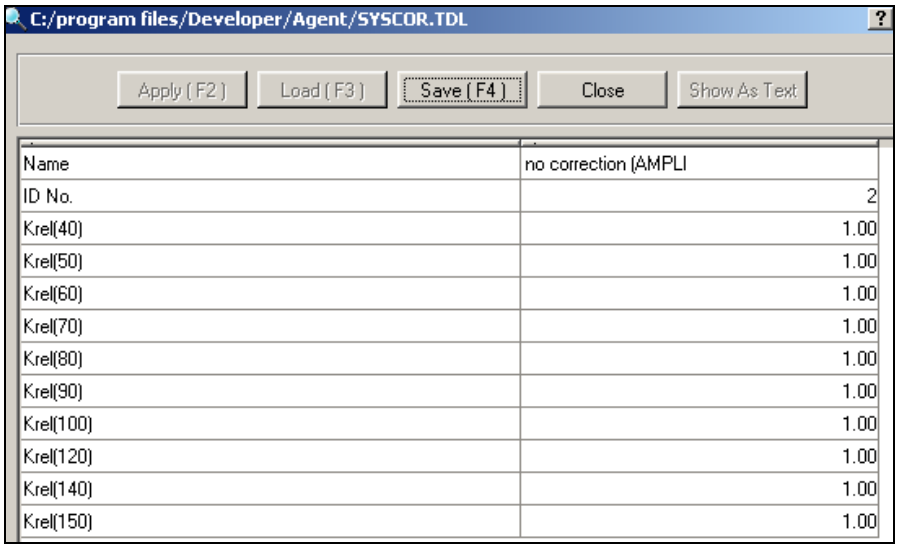
CASSETTE

C:/program files/Developer/Agent/CASSETTE.TDL

Apply (F2) | Load (F3) | Save (F4) | Close | Show As Text

Name	normal cassette(def)
ID No.	1
Factor	1.00

SYSTEM CORRECTION



Name	no correction (AMPLI
ID No.	2
Krel(40)	1.00
Krel(50)	1.00
Krel(60)	1.00
Krel(70)	1.00
Krel(80)	1.00
Krel(90)	1.00
Krel(100)	1.00
Krel(120)	1.00
Krel(140)	1.00
Krel(150)	1.00

CORRECTION FACTOR

The correction factor remains at **1.00** except Agent is used without hard key. Without PC hard key the factor must be used for the S-value / density alignment.

Default data are bold, *calculated values* ***italic***.

kV	FILM	SCREEN	CHAMBER	CASSETTE	SYSTEM CORRECTION	CORRECTION FACTOR	*calculated values for exposure*
40		**176**	**0.70**		**1**		***1.59***
50		**263**	**0.84**		**1**		***1.28***
60		**350**	**0.93**		**1**		***1.06***
70		**400**	**1.00**		**1**		***1.00***
80	**1**	**428**	**1.01**	**1**	**1**	**1**	***0.94***
90		**443**	**1.00**		**1**		***0.90***
100		**444**	**0.99**		**1**		***0.90***
120		**422**	**0.96**		**1**		***0.89***
140		**394**	**0.93**		**1**		***0.91***
150		**380**	**0.89**		**1**		***0.94***
RLF [ms]		no affecting factors	no affecting factors	no affecting factors	no affecting factors	no affecting factors	
0	**1.00**						*1.00*
10	**1.00**						*1.00*
20	**1.00**						*1.00*
50	**1.00**						*1.00*
100	**1.00**						*1.00*
200	**1.00**						*1.00*
500	**1.00**						*1.00*
1000	**1.00**						*1.00*
2000	**1.00**						*1.00*
4000	**1.00**						*1.00*
	1	*2.5µGy*		**1**		**1**	*2.5 µGy*
basic dose of FSC and its possible correction factors							
			0.19V/µGy or *5.24µGy/V* basic chamber sensitivity				*5.24 µGy/V*

Explanations for the ***calculated values for exposure*** value table previous page, example **50kV**:

speed 70kV **400**
---------- = ----- = 1.52 x **0.84** (chamber factor) = ***1.28***
speed 50kV **263**

FILM, CASSETTE, SYSTEM CORRECTION and CORRECTION FACTOR have all factors of **1**.

RLF factors do not apply for CR films. All factors 1.00, see table **FILM** page 3.

Low kV correction is not used for CR systems. The S = sensitivity value will increase (less dose) by the reciprocal value of the following table factor and there will be a non-linear S-value from 40...150kV.

Name	low-kV-correction (d
ID No.	1
Krel(40)	0.70
Krel(50)	0.78
Krel(60)	0.89
Krel(70)	1.00
Krel(80)	0.99
Krel(90)	0.95
Krel(100)	0.92
Krel(120)	0.94
Krel(140)	0.98
Krel(150)	1.00

S-value / density alignment

If required the **Abrreviation** name and the **Dose of FSC** value can be modified.

Abbreviation	B400
Dose Request Chamber [µGy/V]	5.24
Dose of FSC [µGy]	2.50

All other values **must not** be changed

Remark:

Abbreviation Any name up to six characters can be given. The abbreviation name should indicate the programmed speed type if different speeds shall be used with the same imaging plates.

Dose of FSC [µGy]: Use $\mathbf{K_s}$ explanation this page. The value can be adapted to the local "density taste".

All other data (**kV70-Char.** and **RLF**) **must** remain as they have been calculated during the programming and loading process to obtain the chamber type + imaging plate depending kV characteristic. RLF is constant = 1.

Formula to determine the **speed = S** of a film-screen-combination:

$$S = \frac{K_0}{K_s} = \frac{\textbf{1000 µGy}}{\textbf{Dose of FSC [µGy]:}}$$

>> use speed as >> abbreviation >> name

!! S = speed **must not** be mixed up **!!**
!! with *S = sensitivity CR* **!!**

$\mathbf{K_0}$ is a constant with a value of 1000 µGy.
$\mathbf{K_s}$ is a variable value principally representing a switch off dose to obtain a density of 1.0 above base and fog, (normal films determined by the manufacturer of a film-screen system for defined processing conditions which are different in a computed RAD system). Can be adapted to the local "density taste"

If e.g. K_s = 2.5 µGy (like the example on pages 2...5)

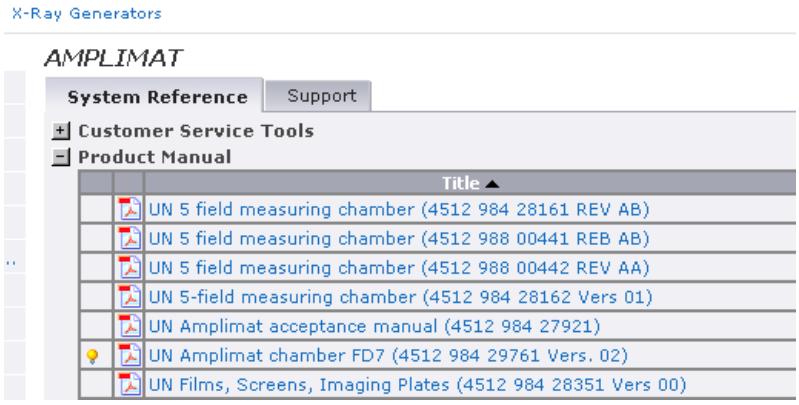
$$S = \frac{1000\ \mu Gy}{2.5\ \mu Gy} = 400$$

Range of **speed values S** within the standard **speed class SC** systems:

only valid for film-screen-combinations for an optical density of 1.0		
Speed class **SC** Standard	dose / exposure [µGy] Standard class **SC**	Speed value **S** Range
6	167	5 - 9
12	83	10 - 18
25	40	20 - 36
50	20	40 - 71
100	10	80 - 140
200	5	160 - 280
400	2.5	320 - 560
800	1.25	630 – 1100
1600	0.625	1250 – 2200

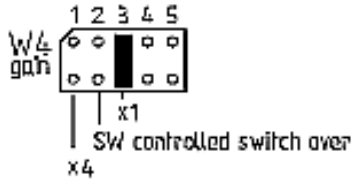
If different speeds shall be used copy one screen with Save and Load it to any other data set of the same or another chamber.
Change **Abbreviation** names and **Dose of FSC** values accordingly afterwards

More information available in booklet "Radiographic screens and films", manual order No. 4512 984 28351 or from the InCenter:

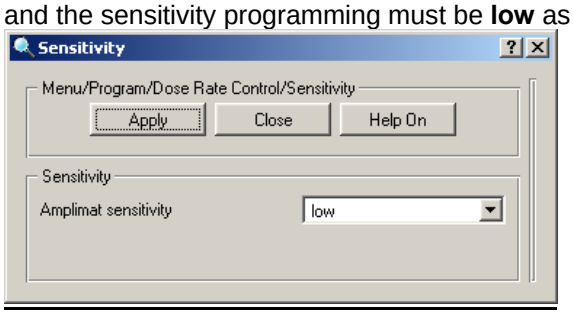

X-Ray Generators
AMPLIMAT
System Reference
Support
Customer Service Tools
Product Manual
Title
UN 5 field measuring chamber (4512 984 28161 REV AB)
UN 5 field measuring chamber (4512 988 00441 REB AB)
UN 5 field measuring chamber (4512 988 00442 REV AA)
UN 5-field measuring chamber (4512 984 28162 Vers 01)
UN Amplimat acceptance manual (4512 984 27921)
UN Amplimat chamber FD7 (4512 984 29761 Vers. 02)
UN Films, Screens, Imaging Plates (4512 984 28351 Vers 00)

<u>Remarks for the 5-field chamber in combination with Optimus:</u>

The new 5-field Bucky chamber **9890 000 7000>1 Bucky** is very sensitive.
The gain jumper EZ150 W4 **<u>must</u>** be set in position 3 = gain **factor x1**

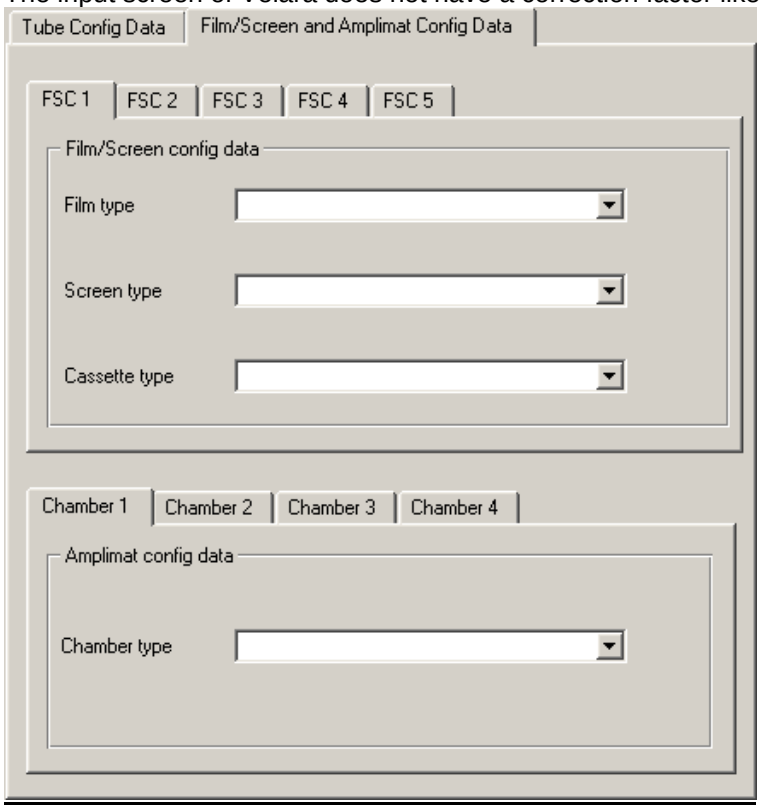


and the sensitivity programming must be **low** as well:

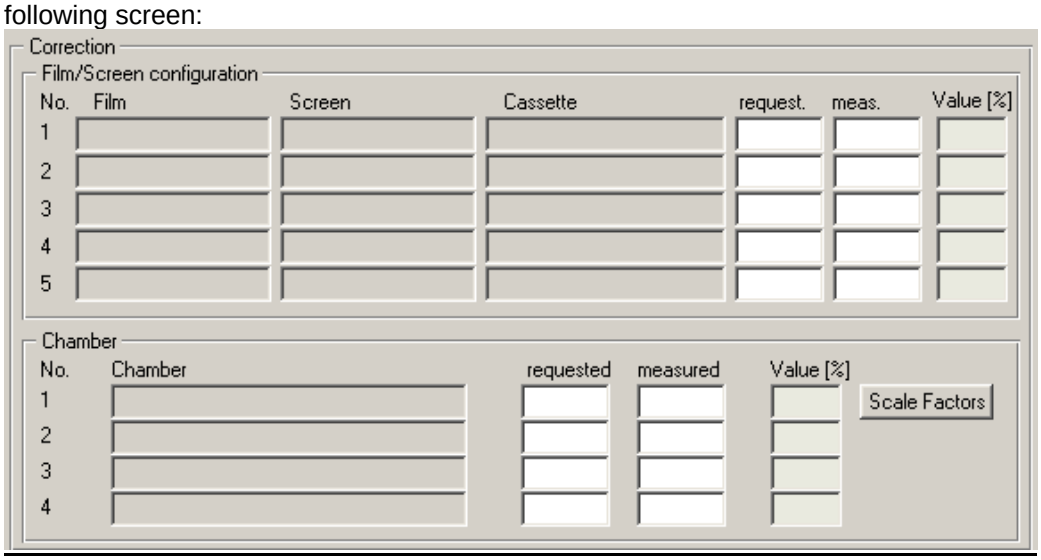


Velara programming of FSC data sets:

The input screen of Velara does not have a correction factor like Optimus.



Once data have been entered and applied the alignment of the S-value or density take place via the following screen:



The

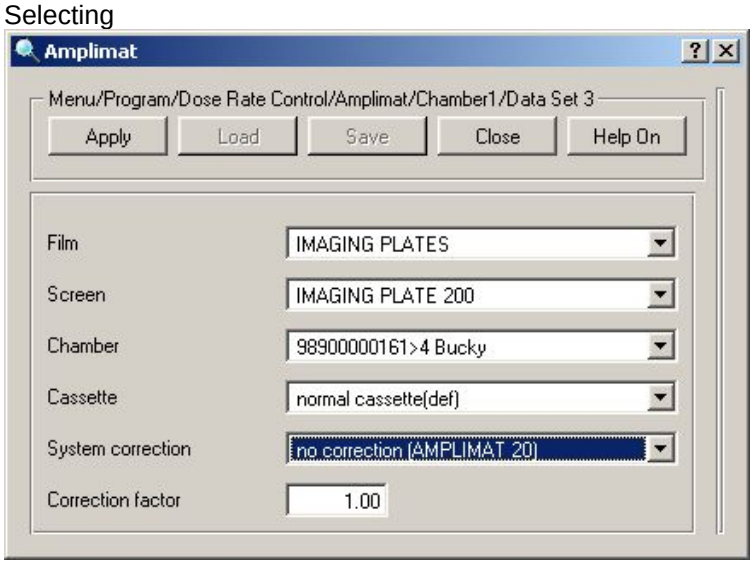
of both screens explains the process if the PC is online with the generator.

Velara R/F generators don't have a calcuation table like Optimus which gets the data from external data files during the programming process.

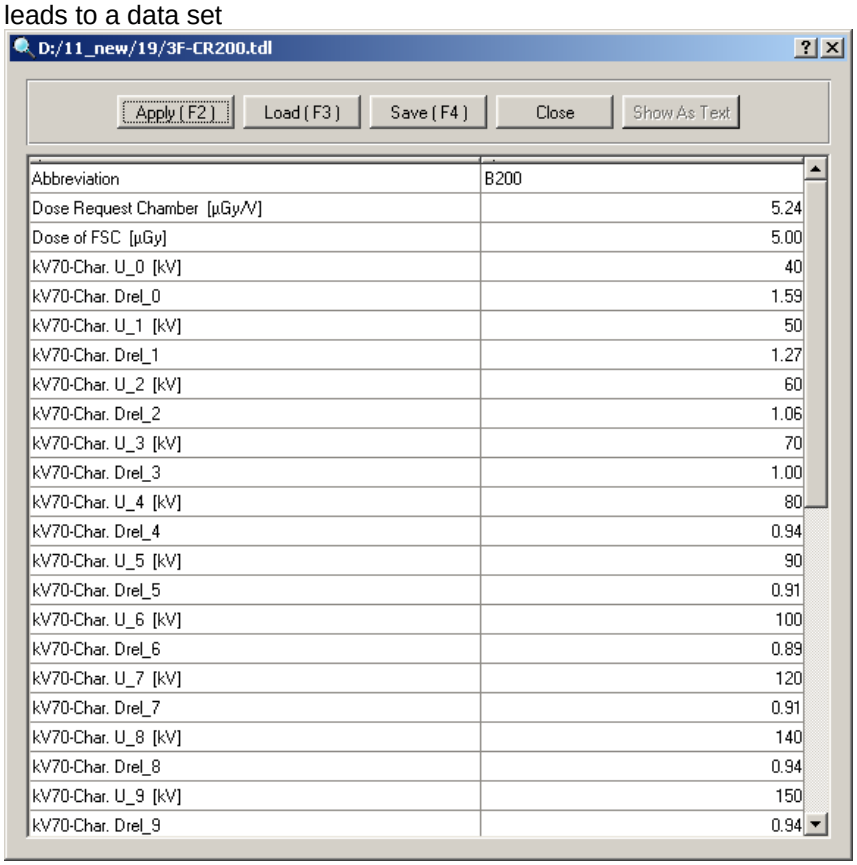
All required data tables are embedded in the basic Velara R/F firmware. Once there is a request for an AEC exposure the threshold value U_off for the exposure termination is calculated from the default data.

3 field measuring chambers 9890 000 0161>4 Bucky

Selecting



leads to a data set



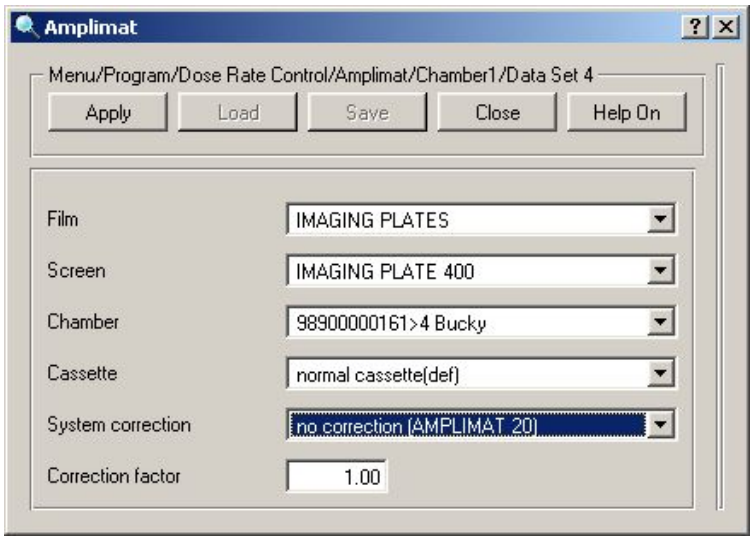
Abbreviation	B200
Dose Request Chamber [µGy/V]	5.24
Dose of FSC [µGy]	5.00
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.59
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.27
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.06
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.94
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.91
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.91
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.94
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.94

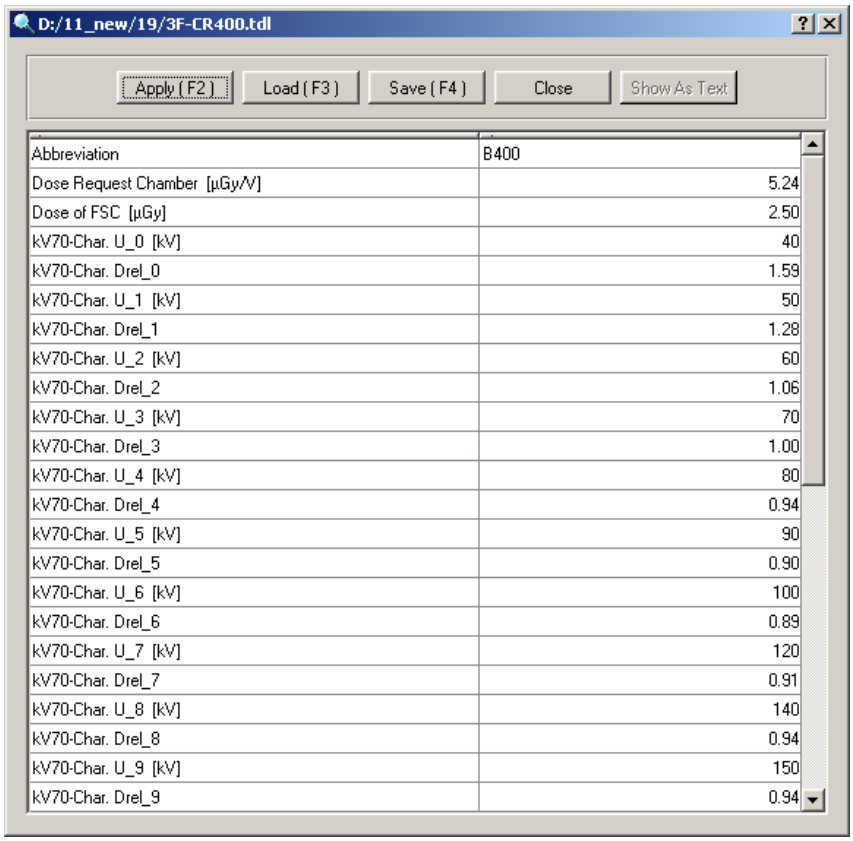
and corresponding DRC data, especially the exposure termination threshold value U_off (here at 70kV)

```
AEC Calculation
Mo 10. Jul 11:53:16 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 3
dose nominal           : 1 OD
dose calculated        : 391
kV factor              : 1
U off                  : 0.954 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```

On the following pages you find the programming + characteristic + DRC details screens for 400 and 800 speed CR in combination with the 3-field Bucky chamber 9890 000 0161>4:

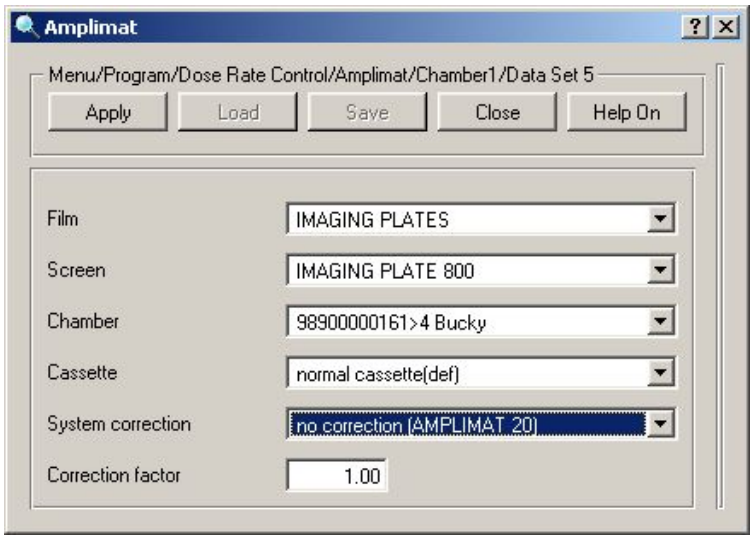


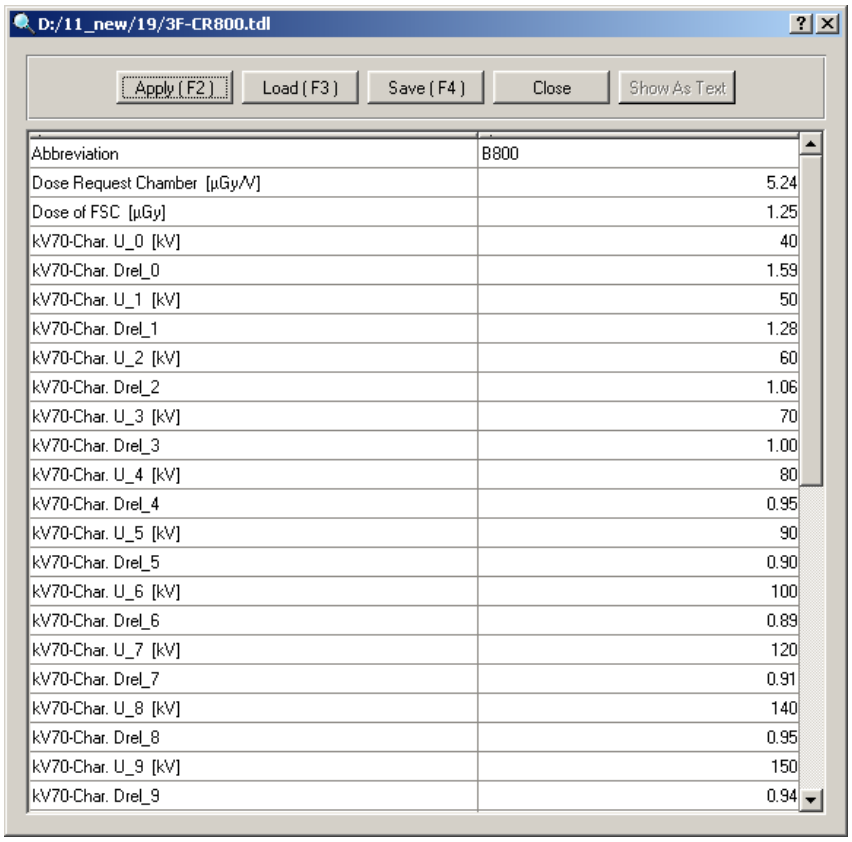


Abbreviation	B400
Dose Request Chamber [µGy/V]	5.24
Dose of FSC [µGy]	2.50
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.59
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.28
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.06
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.94
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.90
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.91
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.94
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.94

```
AEC Calculation
Mo 10. Jul 11:53:38 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 4
dose nominal           : 1 OD
dose calculated        : 195
kV factor              : 1
U off                  : 0.477 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```





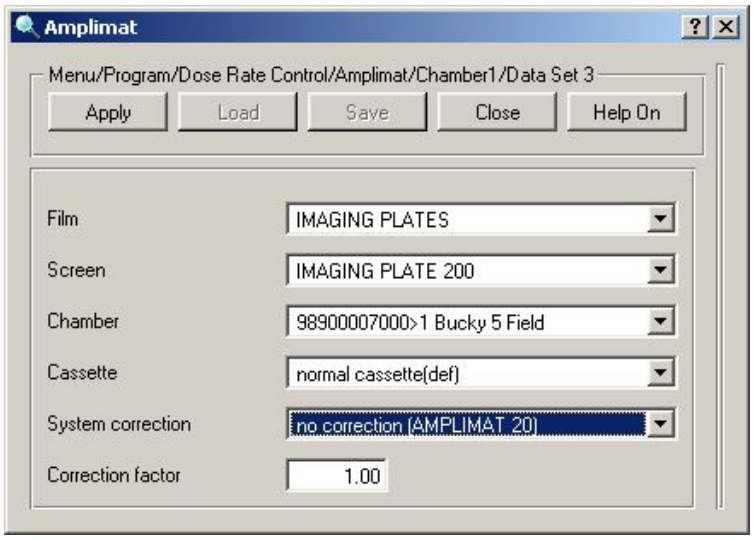
Abbreviation	B800
Dose Request Chamber [µGy/V]	5.24
Dose of FSC [µGy]	1.25
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.59
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.28
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.06
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.90
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.91
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.95
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.94

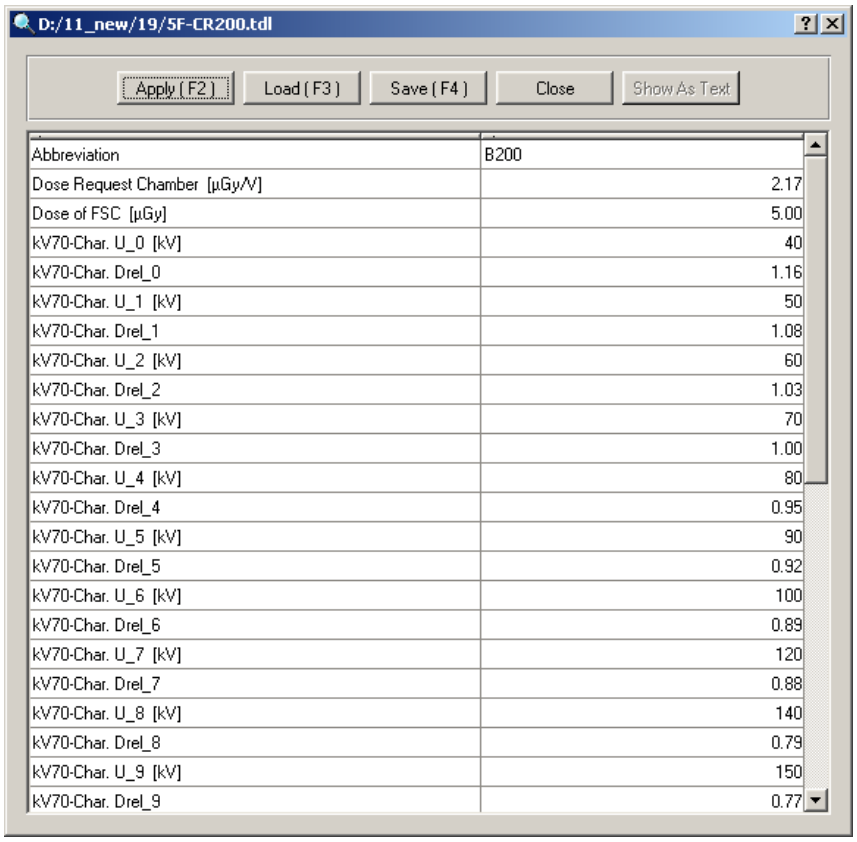
```
AEC Calculation
Mo 10. Jul 11:54:08 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 5
dose nominal           : 1 OD
dose calculated        : 97
kV factor              : 1
U off                  : 0.238 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```

5 field measuring chambers 9890 000 7000>1 Bucky

On the following pages you find the programming + characteristic + DRC details screens for 200, 400 and 800 speed CR in combination with the 5-field Bucky chamber 9890 000 7000>1:

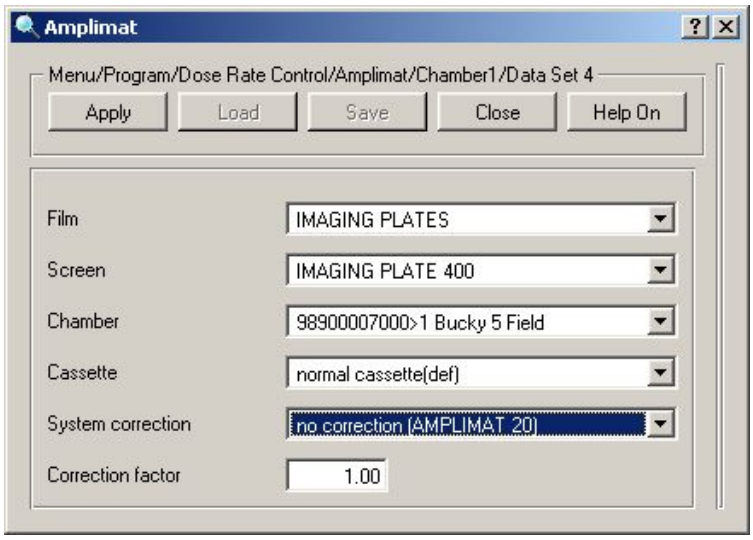


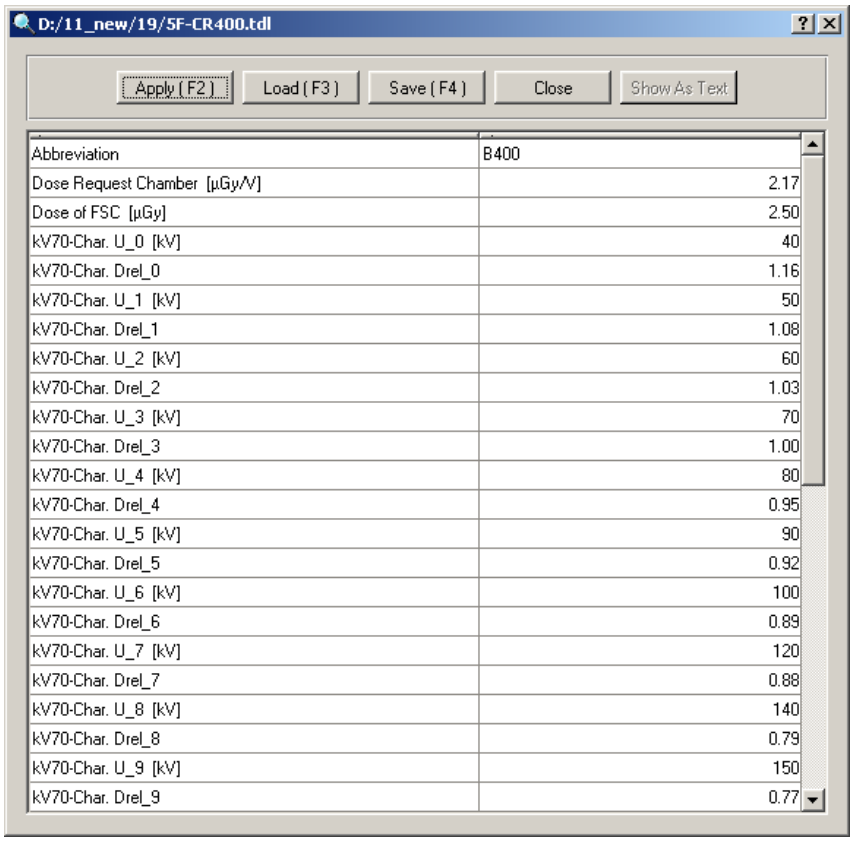


Abbreviation	B200
Dose Request Chamber [µGy/V]	2.17
Dose of FSC [µGy]	5.00
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

```
AEC Calculation
Mo 10. Jul 11:46:17 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 3
dose nominal           : 1 OD
dose calculated        : 943
kV factor              : 1
U off                  : 2.304 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```

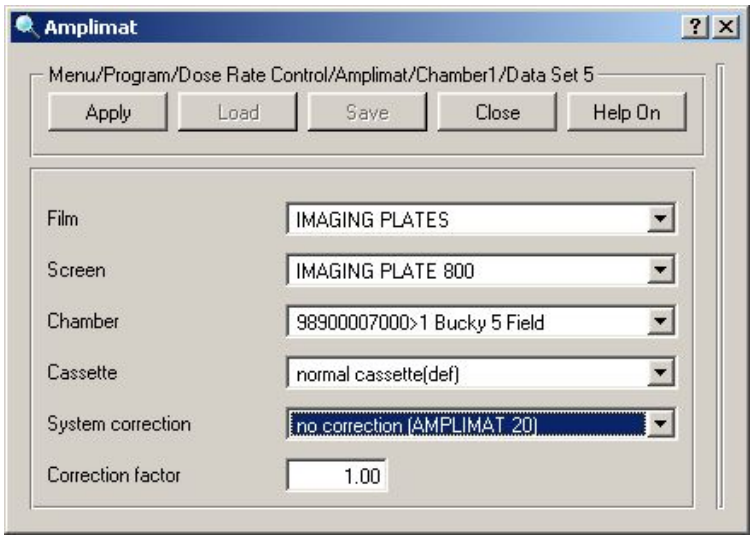


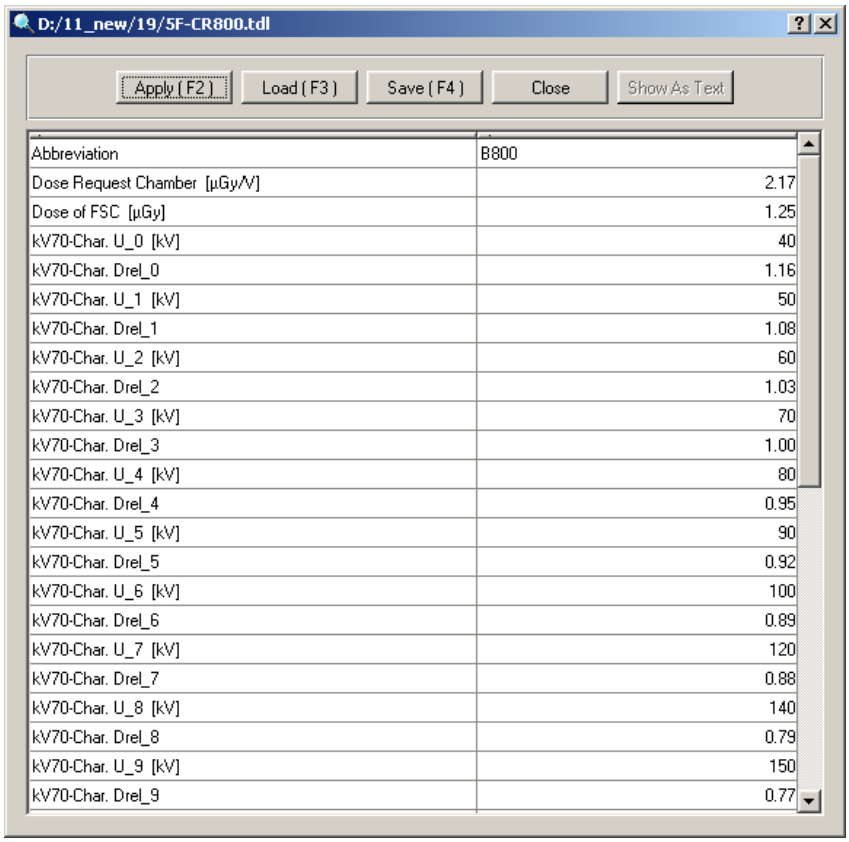


Abbreviation	B400
Dose Request Chamber [µGy/V]	2.17
Dose of FSC [µGy]	2.50
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

```
AEC Calculation
Mo 10. Jul 11:47:04 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 4
dose nominal           : 1 OD
dose calculated        : 472
kV factor              : 1
U off                  : 1.152 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```





Abbreviation	B800
Dose Request Chamber [µGy/V]	2.17
Dose of FSC [µGy]	1.25
kV70-Char. U_0 [kV]	40
kV70-Char. Drel_0	1.16
kV70-Char. U_1 [kV]	50
kV70-Char. Drel_1	1.08
kV70-Char. U_2 [kV]	60
kV70-Char. Drel_2	1.03
kV70-Char. U_3 [kV]	70
kV70-Char. Drel_3	1.00
kV70-Char. U_4 [kV]	80
kV70-Char. Drel_4	0.95
kV70-Char. U_5 [kV]	90
kV70-Char. Drel_5	0.92
kV70-Char. U_6 [kV]	100
kV70-Char. Drel_6	0.89
kV70-Char. U_7 [kV]	120
kV70-Char. Drel_7	0.88
kV70-Char. U_8 [kV]	140
kV70-Char. Drel_8	0.79
kV70-Char. U_9 [kV]	150
kV70-Char. Drel_9	0.77

```
AEC Calculation
Mo 10. Jul 11:48:02 2006

U nominal              : 70 kV
I nominal              : 714.285 mA
t backup               : 240 ms
C eff ht               : 4.750 nF
selected sensor        : Amplimat
dose measurement input: EZX21
film screen comb.      : 5
dose nominal           : 1 OD
dose calculated        : 236
kV factor              : 1
U off                  : 0.576 V
t corrected            : 239.884 ms
t lead AEC             : 0.216 ms
```